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VITAMIN D DEFICENCY AND CULTURAL INFLUENCES AMONG MUSLIM
WOMEN IN SOUTHERN ILLINOIS

by

Durar Kassim Shakir

B.S., Southern Illinois University Carbondale, 2009-05-15

A Thesis

Submitted in Partial Fulfillment of the Requirements for the
Master of Science Degree

Department of Animal Science, Food and Nutrition
in the Graduate School
Southern Illinois University Carbondale
December 2012

THESIS APPROVAL

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Durar Shakir

A Thesis Submitted in Partial
Fulfillment of the Requirements
for the Degree of
Master of Science
in the field of Food and Nutrition

Approved by:

Sara Long, RD, PhD

Kathleen Welshimer, PhD

Lynn Gill, RD, MS

Afroza Hasin, MS

Graduate School
Southern Illinois University Carbondale
December 9, 2011

AN ABSTRACT OF THE THESIS OF

DURAR SHAKIR, for the Master of Science degree in Food and Nutrition,
presented on December 9, 2011, at Southern Illinois University Carbondale.

TITLE: VITAMIN D DEFICIENCY AND CULTURAL INFLUENCES AMONG
MUSLIM WOMEN IN SOUTHERN ILLINOIS

MAJOR PROFESSOR: Dr. Sara Long, RD

This study is an analysis of the cultural influences that affect the prevalence of vitamin D deficiency among Muslim women from sun-rich countries, who now reside in Southern Illinois. Previous studies examine the prevalence of vitamin D deficiency among this population, while neglecting to examine the extent of cultural influences which can affect the likelihood of having this disorder. Low serum levels of 25(OH)D can occur when there are low levels of vitamin D intake, and when exposure to sunlight is limited. Muslim women are more prone to vitamin D deficiency due to traditional attire, regardless of migration.

Upon surveying a convenience sample of 101 Muslim women in Southern Illinois, it was found that upon migration, dietary changes occurred with an increase in dairy consumption and a decrease in fish consumption. The major finding in this study however is the relationship between vitamin D deficiency and concerns of beauty. Among participants, beauty was revealed to be a more important concern than tradition and religion with regard to their practice of covering.

DEDICATION

I would like to dedicate this thesis to my parents: Muna Al-Bayati and Qasim Al-Qasi; my husband Salah Shakir; my children: Ayah Shakir and Menna Shakir; my brothers: Qais Al-Qasi and Duried Al-Qasi; my sister Dena Al-Qasi; and all my good collegiate friends. All of your love, support, time, and encouraging words have helped me so much throughout my graduate school journey. Thank you so much.

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CHAPTER 1

INTRODUCTION

Background of the Problem

Vitamin D is an organic fat- soluble substance that, after activation, becomes a hormone (1). Vitamin D can be found in two forms; first, vitamin D₂ or ergocalciferol is manufactured by plants or fungus (2). Second, vitamin D₃ or cholecalciferol is the most effective form in human body and mainly occurs through the exposure of the skin to UVA and UVB rays (2). Therefore, the most important source of vitamin D₃ is sunlight exposure, and under normal conditions the skin is able to supply the body with 80-100% of the vitamin D requirement (3). Vitamin D₃ can also be obtained by consuming animal products as well as dietary supplements. Some of the best food sources in nature containing vitamin D₃ are foods such as salmon, tuna, sardines and fish liver oils; while the small amounts of it are found in beef liver, cheese, and egg yolks (4). The major biologic function of vitamin D₃ in humans is to maintain serum calcium and phosphorus concentrations within the normal range by enhancing the efficiency of the small intestine to absorb these minerals from the diet (1,2).

Serum concentration of 25(OH)D is the best indicator of vitamin D₃ status as follows (2,5):

- Vitamin D optimal status, 25(OH)D of 50 nmol/L.
- Vitamin D insufficiency, 25(OH)D of 25-50 nmol/L.
- Vitamin D deficiency, 25(OH)D < 25 nmol/L.

Serum 25(OH)D levels do not indicate the amount of vitamin D stored in body tissues.

Human body needs a combination of sufficient amounts of vitamin D and calcium for strong bones as well as to reduce risk of osteoporosis and osteomalacia in adults (2). Adequate amount of this vitamin will also prevent rickets among children (2). Without sufficient vitamin D, bones can become fragile and misshapen. According to the National Osteoporosis Foundation (NOF), the recommendation for adults under the age of 50 is 1,000 mg of calcium and 400 - 800 IU of vitamin D daily. Adults age 50 and older should consume 1,200 mg of calcium and 800 - 1,000 IU of vitamin D₃ daily (2).

A recent study has shown that many cases of rickets among teenagers in Saudi Arabia are undiagnosed and are associated with deficiencies in vitamin D (6). Low levels of bone mineral density have also been associated with low levels of vitamin D, which increases risk for osteoporosis according to a recent study in Morocco (7).

Insufficient amounts of vitamin D are associated with a 20% to 50% increase in the risk of colon, breast and prostate cancer, type 1 diabetes mellitus, Crohn's disease, multiple sclerosis, hypertension, and cardiovascular disease (8,9). Vitamin D deficiency may also be associated with hypertension, secondary hyperthyroidism, calcium malabsorptions, myopathy and fibromyalgia, and increased risk of multiple sclerosis (10). In addition, low serum levels of 25(OH) D are related to increased cardiovascular mortality in a national U.S. sample, particularly among dark skinned people (11).

Restriction of sunlight as a result of decreased ambient light and living in countries located at northern latitudes is easily understood. Other related phenomena affecting sunlight exposure include seasonal variation, time of day when exposed to

sunlight, usage of sunscreen, lowered absorption of vitamin D due to being a dark skinned individual, and those who cover their entire body surface for religious or cultural reasons when outdoors (1,8,9).

Culture might be considered an essential factor influencing limited exposure to sunlight (1). Muslim women are instructed to dress modestly in compliance to guidelines set forth by the Quran, which is the holy book of the Islamic religion (12). Muslim women often dress modestly which ranges from wearing a simple scarf (called a hijab), or full body covering. These coverings limit exposure to the sun “Different kinds of wardrobes typically worn in Muslim countries originate from a variety of cultural traditions and date as far back as the pre-Islamic tribes” (13).

Among Muslim women, the degree of covering the skin varies. This variation in skin covering (modesty) may impact the level of vitamin D absorption by the sun. There are three types of covering. The most complete body covering is the Burqa which involves covering the entire body loosely and the face completely. The next level of covering is the Niqab. This type of covering reveals only the eyes of the woman, while the body remains loosely covered at this level as well. Then, the most common covering is the Hijab. This degree of covering allows for the entire face to be revealed, while continuing to cover the hair. The first two types of covering mentioned, the Burqa and Niqab, are usually dark and solid in coloration, but the Hijab can be dark, or quite colorful. The body covering varies with women who wear a Hijab, from a loose robe to various types of modern clothing, with skin covering minimum to the wrist, including legs.

When Muslim women from sun-rich countries near the equator move to countries with more northern latitudes without changing their habit of avoiding exposure to sunlight, they may be at additional risk for vitamin D deficiency (1,3). In addition, immigrants from sun-rich countries, including those from the Middle East, typically have suntanned colored skin. These women may try to avoid further exposure to the sunlight.

Statement of the Problem

Previous studies have examined prevalence of vitamin D deficiency in Middle-Eastern and Indian Muslim women who wear very modest clothing, but it appears there has been limited attention to the extent of cultural influences relating to vitamin D deficiency. In order to formulate ways to reduce problems associated with vitamin D deficiency among this population, an examination of potential cultural barriers will be conducted. While religiosity among Muslim women is a primary consideration when viewing the effect of low levels of sun exposure as a major deterrent to ensuring proper vitamin D levels, other factors potentially play a part in this as well.

By examining people who have changed their geographic location, insight can be made into the ways in which the causal factors associated with vitamin D deficiency can be reduced. In other words, the researcher needs to look beyond the degree of modesty in order to determine if there are other factors that contribute to this problem. Therefore, when considering culture, even alterations in cultural norms need to be considered as well.

Need for the Study

There is a need to add to the body of literature that has already been established concerning vitamin D deficiency among modestly dressed Muslim women. The literature indicates Muslim women immigrants had greater vitamin D deficiency in comparison to native individuals. However, recent research has failed to show if immigrants had vitamin D deficiency before their immigration.

While most studies focused on the modest clothing of women from Muslim countries, perhaps there are various elements within their culture that contribute to the need for greater sun exposure as well. Through examining various factors that might play a part in deficiencies of vitamin D, plans for change to address this deficiency can be made in an accurate and targeted manner. Among potential factors that can also play a part in the inhibition of change are such things as culture, religion, and diet.

Purpose of the Study

The purpose of this study was to examine cultural influences regarding inadequate sun exposure in modestly clothed immigrant Muslim women relating to vitamin D deficiency. The population examined was a sample of convenience located in a small mid-western university town in the United States. The study examined dietary changes among this population in order to ascertain if there is any increased or decreased risk as a result of geographic relocation. Glerup, et. al. (2000) stated "It is obvious that moving people from sun-rich countries to countries with more northern or southern latitudes without changing their habit of avoiding direct sunlight exposure may cause vitamin D deficiency" (5).

Research Questions

1. Do cultural factors such as views of beauty, concerns for health, or religion contribute to lack of sun exposure among immigrant Muslim women, thus increasing the prevalence of vitamin D deficiency?
2. Do Muslim women consume adequate amounts of vitamin D in their diet while in their native homeland, and after immigrating to the United States?

Summary

Vitamin D is essential to maintain normal blood levels of calcium and phosphorus, and aids in the absorption of calcium, helping to form and maintain strong bones. Vitamin D is used, alone or in combination with calcium, to increase bone mineral density and decrease fractures. Vitamin D has two forms and both are important in humans: vitamin D₂ or ergocalciferol and vitamin D₃ cholecalciferol which is the most important form. Vitamin D₂ is synthesized by plants and vitamin D₃ is synthesized by humans in the skin when it is exposed to ultraviolet B (UVB) rays from sunlight.

Vitamin D₃ is also obtained from a few dietary sources such as fatty fish, and dietary supplements as well as vitamin D₃-fortified foods. Insufficient amounts of vitamin D in the human body might increase risk of having various diseases among adults such as osteoporosis, osteomalacia, colon and breast cancer, type 1 diabetes, and cardiovascular disease as well as rickets among children. Restriction of sunlight as well as darkness of skin can decrease potential benefit of maintaining optimal vitamin D. Sensitivity to cultural practices is extremely important and may contribute to dietary habits in addition to voluntary exposure to sunlight. As a result of the importance of vitamin D in human's health and cultural influences which may exist, more analysis of previous research and more study to at-risk population need to be done.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

This chapter will be divided into four main sections. First, issues relating to vitamin D such as what it is, and why it is important, sources of vitamin D, and effects of lack of vitamin D within the human body will be presented. After the various issues relating to vitamin D are discussed, the population to be examined within this study will be viewed. Prevalence of vitamin D deficiency and region of origin of Muslim women will then be viewed. Then, various aspects of culture and how it potentially plays a part in the incidence of vitamin D deficiency among this population will be examined. Finally, a summary will be given of the literature reviewed and how this information supports this study that is being undertaken.

Vitamins and Nutrition

Vitamins are considered important to the general health of the human body. “Vitamins and minerals are essential to life” (14). It is difficult to determine how much of any given vitamin is needed for overall good health. However, in 1943 the US government funded a council of scientists to determine basic nutrient guidelines for the population (13). The council devised the Recommended Dietary Allowances (RDAs) (13).

Definition and Sources of Vitamin D

Vitamin D is a steroid vitamin, a group of fat-soluble prohormones, which is naturally present in some foods such as fatty fish, egg yolk, and liver, as well as its availability as a dietary supplement (5). It is also produced endogenously when skin is exposed to ultraviolet rays from sunlight. Individuals need sufficient quantities of sunlight exposure to get sufficient vitamin D synthesis in the skin, which is able to supply the body with 80-100% of the vitamin D requirement (3,5,15).

Five forms of vitamins D that have been discovered, vitamins D₁, D₂, D₃, D₄, and D₅. The most important two are vitamins D₂ (ergocalciferol) which is available from plant sources, and D₃ (cholecalciferol) which is available from animal sources (2,5,16).

Vitamin D₃ is made in the body from a chemical reaction to the ultraviolet radiation in sunlight. When human's skin is exposed to ultraviolet (UV) radiation, vitamin D₃ is formed by the conversion of 7-dehydrocholesterol (5,15,16).

Vitamin D Status

Vitamin D status is often defined by serum level of 25(OH)D concentrations and there are various terms used to describe vitamin D status such as sufficiency, insufficiency and deficiency (4,5). The serum level of 25 (OH)D concentrations are as follows (5):

- Vitamin D optimal or sufficient, 25(OH)D of 50 nmol/L.
- Vitamin D insufficiency, 25(OH)D of 25-50 nmol/L.
- Vitamin D deficiency, 25(OH)D < 25 nmol/L.

Vitamin D Daily Recommendation

According to the Office of Dietary Supplements, the National Institutes of Health and National Osteoporosis Foundation (NOF) recommend adults under the age 50 should have 1,000 mg of calcium and 400 – 800 IU of vitamin D daily. Adults age 50 and older should have about 1,200 mg of calcium and 800 –1,000 IU of vitamin D daily (2). Even limited exposure to sun in the amount of 10 minutes three times each week is considered adequate for prevention vitamin D deficiency. Regions of bodily exposure should include the head and arms (10).

Importance of vitamin D

Vitamin D is essential for enhancing calcium absorption in the small intestine and for sustaining sufficient serum calcium and phosphate concentrations to maintain healthy bones (17). It is also important for bone growth and bone remodeling by osteoblasts and osteoclasts. With an inadequate amount of vitamin D₃, bones can become thin and fragile (18). Some studies show that vitamin D deficiency leads to osteomalacia and osteoporosis in adults (2,18) and rickets in children (17,18). Vitamin D has other roles in human health; it can play a role in decreasing the risk of many chronic illnesses, including common cancers, autoimmune diseases, infectious diseases, and cardiovascular disease (19).

Population – Muslim Women

When examining health issues around the world, there are various groups of people that can be either more prone or less prone to various types of deficiencies,

depending on such things as environmental, social, and cultural influences. One group which will be examined within this study is Muslim women. Although Muslim women live around the globe, literature associated with vitamin D deficiency among those women as a group will be examined next.

Prevalence of Vitamin D Deficiency among Muslim Women

When looking at the prevalence of vitamin D deficiency among Muslim women, numerous studies seem to agree that a high rate deficiency of D vitamin does exist. Within a study of children in Saudi Arabia, it was found that 81% of children had low levels of vitamin D within their blood and 40% had very low levels (9). In Morocco, a study was conducted among 415 adult women between the ages of 24 and 77. Results of the study showed 91% of women had low levels of vitamin D (10). Even when examining Danish Muslim women who had a moderate vitamin D intake, vitamin D deficiency were still found (3).

In a study undertaken in Dearborn, MI, Arab-American Muslim women who lived in a traditional Islamic cultural pattern were shown to have severe vitamin D deficiency as well (6). When examining prevalence of vitamin D deficiency among Muslim women who immigrated to western regions, very low serum concentration of 25(OH)D was common (6). Even though prior deficiency had not been determined within many of these studies, previous researches have shown women from these countries have vitamin D deficiency (17). In other words, veiled women who have immigrated to the west appear to have hypovitaminosis D prior to and after immigration (17).

Region of Origin

Muslim women reside in various locations throughout the world. When examining studies relating to vitamin D deficiency, geographic region of origin had some commonality. One study revealed that an estimated 35-80% of children in Saudi Arabia, India, Turkey, Israel, and Egypt have vitamin D deficiency (16). Another article showed overlapping and added countries among nations having high incidences of vitamin D deficiency, including Lebanon, Saudi Arabia, Kuwait, and Jordan (20). Turkey and Morocco are other countries that have also had reported high levels of vitamin D deficiency among their population (4). Pakistani immigrants to Denmark were found to have this problem as well (17). Among Lebanese, an extensive study was undertaken viewing both Muslim and Christian women within their population have low level of vitamin D (21).

As can be seen from all of the above, there is a regional element of origin that is prominent. When looking at the globe, it can be seen that these countries are at or are north of the Tropic of Cancer in the Eastern Hemisphere where levels of sunlight are great. When considering this information, it seems obvious that other major factors must play a part in vitamin D deficiency among individuals from this region.

Cultural Influence – Source and Analysis

Culture affects many aspects of people's lives. When viewing various facets of life among Muslim women, there are many factors that can contribute to their low levels of vitamin D. Faith is their major importance (13). By the definition of being "Muslim

women”, it is evident their religious beliefs in Islam are influential in those women’s’ lives (13). What traditions within Islam can affect levels of vitamin D?

Since consumption of food products that contain vitamin D as well as exposure to the sun are ways in which human beings absorb and metabolize vitamin D (4), clothing and food consumption must be considered. Additionally, cultural influences may connect with sun exposure, clothing, and food sources of vitamin D consumption to reach the optimal level of it among those women.

Islam – The Source of Cultural Influence

Followers of Islam are called Muslims (13). The holy book of Islam is called the Quran (12). According to the Quran, the fundamental belief of Islam is followers must submit to one God (Allah), and believe Muhammad is the last prophet of God and the deliverer of His final and complete revelation (12). Within the text of the Quran, guidelines for living are given that include the importance of women dressing modestly along with guidelines that involve the consumption of foods (13).

Islamic Views of Modesty

Within the writings of the Quran, it is explained that women should preserve their beauty and to drape the hair covering across their bodies in modesty, for only close male relatives and women’s husbands should be privileged to see this (Sura 24, Ayah 31, Quran) (12). As a result, female followers of Islam often appear in public wearing modest clothing such as long robes depending on the degree of covering the skin as

well as wearing a scarf or veil (12,13). That might lead them to limit sun exposure and obtain inadequate amount of vitamin D₃ from sunlight (2,13)

An underlying perception of skin coloration and its connection with views of beauty is also a potential factor that may contribute to the desire to keep the skin from being darkened as well. Within the United States, it has been shown that preferences have existed towards people with light skin coloration. In addition, self-esteem has been shown to be affected by this preference (22). When examining the views of beauty among Indonesians, research revealed that perceptions are constructed transnationally due to the transfer across national boundaries. There, as with other Asian countries, including the middle-east, skin whitening beauty products are advertised and promoted socially (23).

According to a study of vitamin D deficiency among Arab Muslim women living in Denmark, most Arab Muslim women, regardless of whether veiled or non-veiled (less observant), avoid sunlight exposure and wear modest clothing when they go outside (3). Although the World Health Organization is concerned with high amounts of ultraviolet light exposure, there is an increasing concern with vitamin D deficiency, especially among groups of people who cover their skin for religious or cultural reasons such as modest Muslim women (24,25). It was found in Morocco that although there is abundant sunlight, there are low levels of sun exposure among people in one study as a result of excessive physical covering of the body related to sociocultural and religious influences (10).

A study of Danish Muslim women revealed lack of sun exposure due to covering of skin was one of the factors related to vitamin D deficiency among Arab Muslim

women taking part in their study (3). A Turkish study found by examining the degree of veiling among Muslim women, that women with lowered sun exposure were more deficient than those who did not follow traditional Islamic style of dress (26). The degree of covering the skin in traditional Islamic attire was found to be an important factor increasing risk of osteoporosis in one Moroccan study (10). Turkish immigrants in Germany reportedly are more likely to complain of bone and muscle pain than native Germans (1).

Bone and muscle pain are symptoms that are related to vitamin D deficiency. One study discussing the connection between musculoskeletal pain and vitamin D deficiency revealed among 350 adolescent girls with rickets in Saudi Arabia, 26% experienced back pain, 14% suffered from bone pain, and 4% had muscle pain (9). These results reveal that among the types of bone pain and/or muscle pain, back pain was experienced more.

Dietary Consumption of Vitamin D

Since exposure to the sun is the major source of vitamin D absorption (3), and this is in question among this population, the second major source must be viewed, which is dietary consumption (4). Foods such as liver, beef, eggs, milk products and various types of fish are examples of food sources of vitamin D (4).

Calcium is a crucial factor associated with levels of vitamin D in the human body. Along with exposure to the sun, there was found in a study undertaken in Saudi Arabia, that there was a strong correlation between inadequate sun exposure and low consumption of calcium which causes an insufficient level of vitamin D (9). In a cross-

sectional study of 75 East African immigrant women in Washington state found women with 25(OH)D < 15 ng/mL, were less likely (66%) to drink milk than women with 25(OD) > 14 ng/mL (1).

In Lebanon, vitamin D-rich foods such as fish and supplemented milk are the most common secondary sources of vitamin D instead of regular dairy milk-based products due to the high prevalence of lactose intolerance in the Lebanese population (21). One study revealed the diet of several national groups of people including Pakistani, Turkish, Sri Lankan, and Iran consume foods rich in vitamin D, including fatty fish which is strongly associated with high levels of vitamin D (20). Therefore, the picture that emerges is one in which countries that are in the same general region where Muslim women live or originate, have low consumption levels of milk and related dairy products (21). It seems the vitamin D consumed is predominately from fish products instead (21).

Lactose intolerance may play a part in the lack of consumption of dairy products by people in the middle-east. In a 1971 study of adult Arab villagers, 80.6% had symptoms of lactose intolerance (27). A few years later another study was undertaken to examine prevalence of lactose intolerance involving Jordanian Arabs. This study revealed 64.3% were found to have this problem (28). In addition to this, a book analyzing Arab genetic disorders stated "lactose intolerance is one of the most common disorders in the world" (29) p.123. In this book, Earnest Abel reported that less than 20% of those in the United States from Northern and Western European ancestry had lactose intolerance, whereas over 80% of those from Arab or middle-eastern descent were found to have lactose intolerance problems (29).

Socioeconomic status is another thing to be considered when examining vitamin D deficiency. Those with lower incomes are less likely to live in homes with private back yards, thereby limiting access to sun exposure (9). Among adolescent girls in western Saudi-Arabia 63% of residents from low income homes (less than 3,000 Riyals, approximately \$1,000 monthly) were found to have low levels of vitamin D, whereas 47% of moderate income (3,000-8000 Riyals monthly) and 44% of upper income (over 8,000 Riyals monthly) residents had this problem too (9). Therefore income appears to have some influence in increased levels of vitamin D deficiency, but insufficient level of this vitamin has been shown to be consistently present among all income levels.

Summary

Vitamins and nutrients are essential for the human body. Vitamin D is among the vitamins needed to help prevent various diseases and disorders. Studies indicate that the effects of a vitamin D deficiency contain an elevated risk of developing bone diseases such as osteoporosis; cancers; cardiovascular disease; and autoimmune disorders like multiple sclerosis, and Type 1 diabetes.

Low serum level of 25(OH)D can occur when usual intake of vitamin D is lower than recommended levels as well as exposure to sunlight is limited. When looking at the unique cultural and religious influences upon Muslim women, higher level of vitamin D deficiency is readily apparent. "Many studies have found that cultural attitudes and beliefs act as barriers to patient compliance, especially in the area of diet" (18). Some of these cultural barriers, such as covering of the skin, are based in religious beliefs among this population. These things can pose a serious barrier to reducing vitamin D deficiency among this population. A large influx of Muslims has immigrated to United States and Europe during the past years. It seems from the literature reviewed that Muslim women are not only more prone to vitamin D deficiency due to the traditional attire that many Muslim women wear, but it appears that migration does not lower the prevalence. It appears that perhaps cultural roots are being maintained regardless of geographic location. As a result, further research needs to be undertaken in order to examine further the effects of culture as it relates to vitamin D deficiency among Muslim women.

CHAPTER 3

METHODS

Introduction

While literature pertaining to vitamin D deficiency among Muslim women focuses primarily on the fact that the majority cover their hair and some of their skin, there are other factors and facets that need to be explored to get a full understanding of the problem. There is a lack of empirical studies that address various aspects affecting vitamin D deficiency among this population; therefore, this study has attempted to fill some of this void. This chapter will discuss methods that were utilized in this study, including a description of the sample surveyed, survey instrument, method of survey administration, and method of analysis used.

Sampling

The Muslim women chosen for this study were those who currently reside in southern Illinois. In this region there are only two mosques (Islamic houses of worship), and most religious adherents to Islam from this area attend at one of these locations. As a result, these two mosques were used as locations to solicit potential participants for completing the questionnaires in this study. While this region is predominately rural, there is a substantial influx of people from other parts of the country and the world into this region. The presence of Southern Illinois University Carbondale has led to the presence of an Islamic community within this general area from which to draw subjects for this study.

A paper survey with consent form (Appendix A) distributed by hand was the chosen method for conducting this study, in order to reduce the response time, and to lower associated expenses. Those surveys was started to distribute on Monday, August first, 2011 and completely conducted on Thursday, September first within same year, during the holy month of Ramadan. Ramadan is the ninth month of Islamic calendar when Islamic fasting initiates (most Muslims abstain from food, drink, and certain other activities during daylight hours). Thus, a hundred and one participants were, successfully, involved in this research project. To assist in obtaining this information, the Imam (Islamic prayer leader) made an announcement on a Friday after prayer, encouraging women to participate in this study. Collection and distribution of surveys occurred at the Carbondale Civic Center instead of the mosques due to remodeling of the current facilities.

While there are numerous countries that contain Muslim women and are from the region being examined, fourteen nations were represented from the respondent surveys. The women participating in this study numbered 101 Muslim women of various nationalities. The majority of women ($n=22.8\%$) were from Saudi Arabia; ($n=12.9\%$) were from Pakistan; and ($n=11.9\%$) were from Bangladesh and Palestine. Other nations represented were Afghanistan, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, and Syria (See Table 1). Because this study was an exploratory study, the findings can not be applied to the entire population of Muslim women. Although this is a limitation since not all nations that would fit the criteria are represented, the variation gives room for deviation based upon origin. This study was reviewed and approved by

the SIUC Human Subjects Committee (Appendix B) through the Office of Research Development and Administration, Southern Illinois University, Carbondale, IL

The Survey Instrument

The survey utilized in this study (Appendix C) contained 43 questions, and was designed to elicit responses from Muslim women (See Table 1).

Table 1- Survey Design

1. Culture	2. Religion	3. Diet
A. Views of beauty	A. Level of	A. Dairy product consumption
B. Views of modesty	observance	B. Health problems and diet
C. Views of skin coloration	B. Degree of	C. Fish consumption
D. Perceptions of aging	covering	
E. Clothing traditions		

This survey was designed to elicit responses to determine personal views and personal habits relating to items being analyzed within this study. A portion of the survey was adapted from a survey designed by Thomas et al., used in their 2010 study regarding sun avoidant attitudes and behaviors in the United Arab Emirates (30).

While the majority of questions used a Likert scale and yes or no responses, there were many scaled questions as well. In addition, questions measuring demographic characteristics were asked. The Likert scaled format used responses by the categories 1-strongly disagree, 2-disagree, 3-no opinion, 4-agree, or 5-strongly agree. Other Likert scaled questions varied from this format however. In the next

question, the options were 1-severe, 2-some, 3-moderate, 4-few, or 5-none. Last Likert scaled questions were dissimilar to the previous ones. In those questions, the options were 1-never, 2-rarely, 3-sometimes, 4-frequently, or 5-always.

While Likert scale questions were as stated above, during analysis these variables were collapsed into 3 categories each. Questions eliciting responses of agreement were collapsed into disagree, no opinion, and agree. For the question inquiring into extent of lactose intolerance symptoms experienced, responses were collapsed into severe, some, few, and none. The option of some and moderate could be considered synonymous, and were therefore combined. The last set of Likert scaled responses were collapsed into the responses never or rarely, sometimes, and frequently or always.

Prior to asking the above items however, questions were asked to first examine the perception of importance of multivitamins and their use, views of the importance of vitamin D, and whether or not the participant has been previously tested for vitamin D deficiency. One question was asked to determine if the respondent has had symptoms of lactose intolerance, and 3 questions were asked to determine if each person has experienced some of the symptoms associated with vitamin D deficiency. Finally, at the end of the survey, demographic questions were asked to ascertain individuals' age, country of origin, and level of education.

Pilot Study

Prior to utilizing the questionnaire described, a pilot study was undertaken in order to obtain comments and suggestions regarding the survey prior to administration,

and to determine the reliability of the questions within the survey instrument. A total of 21 Muslim women from various ethnic backgrounds who have undergraduate and graduate education were asked to review and complete the questionnaire. Among these women were also several professional Muslim women who agreed to participate as well. Women asked to participate in the pilot study had the same characteristics as the population sampled in the main research project.

Each survey was hand-delivered to participants and collected upon completion. After gathering completed surveys and entering data into SPSS for Windows Version 18 (2010), responses were examined. A Reliability Test of Internal Consistency (Cronbach's Alpha) (Appendix D) was run for three major groups of questions, indicators of vitamin D deficiency, views of skin coloration, and covering of skin.

Within the questions that are indicators of vitamin D deficiency, one question was found to negatively affect internal consistency ($\alpha=.298$); therefore, was removed. This question was, "Have you experienced pain in your bones for unknown reasons?" For questions examining the covering of skin of Muslim women, one item eliciting a frequency response also negatively affected internal consistency ($\alpha=.497$), "When I am not busy during the day I like to spend time outdoors". This item was removed in order to obtain a satisfactory level of internal consistency. The greatest amount of difficulty with internal consistency however was with responses to perceptions of skin coloration. From the responses given it was evident contradictory views existed. Statements that implied lighter or darker skin was more attractive in their opinion differed from what they wanted and viewed regarding their own skin, and what they felt the views of others are. As a result three questions were deleted in order to achieve an acceptable level of

internal consistency ($\alpha=.094$): “I think lighter colored skin is more attractive than darker skin; I think most people think light colored skin is more attractive than darker skin; I think people with sun tans look more attractive; I think skin lightening cream helps dark skinned people look more attractive”.

Method of Analysis

The statistical package utilized for the analysis of the data was SPSS for Windows Version 18, (2010). Question topics and responses were entered into the data editor and given definitions prior to analysis. Nominal responses were coded and entered into the data editor as well. Statistical analysis included descriptive statistics, several types of bivariate analysis, and included tests of significance. Participants answered all questions applicable. Some individuals informed the researcher they did not consume milk products due to lactose intolerance, therefore they did not respond to those questions. All data and surveys have been preserved and stored for possible further academic analysis and consideration.

CHAPTER 4

RESULTS

Sample Population Demographics

Out of 120 surveys distributed, a total of 84.2% (total n=101) questionnaires were completed by Muslim women who chose to participate in this survey. The age of women involved in this study ranged from 20 to 65 years of age with a mean of 37.12, a median of 35, and a standard deviation of 10.64. The amount of time reported residing in the United States varied widely. The range was from 1 year to 40 years, with the average amount of time being 10.14 years, having a standard deviation of 8.94.

Table 2- Participants by Country of Origin

Country of Origin	Frequency (n=101)	Percent	Percent (n=101)
1 Saudi Arabia	23	22.8	99.0
2 Pakistan	13	12.9	64.4
3 Bangladesh	12	11.9	16.8
4 Palestine	12	11.9	76.2
5 Libya	6	5.9	46.5
6 Iraq	6	5.9	30.7
7 Iran	5	5.0	24.8
8 Lebanon	5	5.0	40.8
9 Morocco	5	5.0	51.5
10 Afghanistan	5	5.0	5.0
11 Jordan	3	3.0	33.7
12 Egypt	3	3.0	19.8
13 Kuwait	2	2.0	35.6
14 Syria	1	1.0	100.0
Total	101	100.0	

National origin, as shown in Table 2, also varied greatly among this sample population, with 14 nations being represented. The greatest proportion of participants

reported being from Saudi Arabia, with 22.8% (n=23) of women reporting having originated from that country. The second greatest representation was reported from Pakistan, 12.9% (n=13). Following that, those reporting originated from Bangladesh and Palestine were both 11.9% (n=12). Lower proportions originated from the nations of Afghanistan, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, and Syria (See Table 2).

The vast majority of women reported being highly educated. This was expected due to the fact the majority of individuals living in this area are affiliated with Southern Illinois University either directly or indirectly, or have family members in the United States working in a professional field. In either case, it would be expected that these women would be likely to have had a fair amount of education either prior to, or as a result of being here in the United States (See Table 3).

Table 3- Degree of Education among Participants

Degree of Education	Frequency (n=101)	(n)%	Percent (n=101)
1 Less Than High School	5	5.0	5.0
2 High School	3	3.0	7.9
3 Some College	10	9.9	17.8
4 Bachelor's Degree	26	25.7	43.6
5 Post Graduate Study	10	9.9	53.5
6 Graduate Degree	33	32.7	86.1
7 Doctorate	14	13.9	100.0
Total	101	100.0	

Only 3% (n=3) of respondents reported having a high school education or less, while 9.9% (n=10) reported having some college education. Those reporting having bachelor's degrees amounted to 25.7% (n=26) and individuals reporting some additional

graduate work were 9.9% (n=10) of this sample population. Participants reporting a graduate degree were 32.7% (n=33) of the population, and those reporting having doctorate degrees amounted to 13.9% (n=14). Therefore, the majority of women in this study reported having obtained a graduate degree, followed by a bachelor's degree, and thirdly a doctorate.

Cultural Factors and Vitamin D Deficiency

When examining cultural factors such as views of beauty, concerns for health, and religion, 78.2% (n=79) participants indicated they do not show their skin in public, and view it as being immodest as a result of their culture. Specific factors such as views of beauty, health, and religion however, revealed variations in responses. When responding to the statement "I think most people think light colored skin is more attractive than darker skin" 74.3% (n=75) agreed (See Table 4). When replying to statements involving personal beauty questions however, response in agreement was less, but still around 50% (n=50), indicating a feeling the respondent would be unhappy if the sun made the skin darker resulted in an agreement of 50.5% (n=51). Being careful when going out in the sun so their skin complexion won't look bad had an agreement response of 56.4% (n=57), and avoiding sun exposure because participants feel it will make their skin wrinkle resulted in 50% (n=50) agreement. Health concerns with the statement that these individuals cover their skin and use sun screen because of the risk of cancer resulted in only 42% (n=42) agreement. Covering skin as a result of religious beliefs however was reported by 85.1% (n=86) agreement (See Table 4).

While responses above were for all women involved in the survey, the research question asks about whether cultural views increase the prevalence of vitamin D deficiency. In order to ascertain whether these views increase prevalence of vitamin D deficiency, examining responses of people who tested positive for vitamin D deficiency was needed.

Within the entire sample population (total n=101), 42% (n=42) participants reported testing for vitamin D deficiency. Among this group, 26 (62%) of respondents were tested positive of vitamin D deficiency (See Table 4). Within same group, 65.4% (n=17) reported showing skin in public is not modest due to cultural traditions, whereas 74.3% (n=75) of the entire sample population reported they did. When examining views of beauty however, for each question, vitamin D deficient respondent reporting agreement than in the entire sample population. Eighty nine percent (n=23) of vitamin D deficient respondent reported agreement versus of the total sample 74.3% (n=75) when believing that most people think light colored skin is more attractive than darker skin. Agreement that the respondent would be unhappy if the sun made their skin darker was reported by 65.4% (n=17) of vitamin D deficient women, and only 51% (n=51) for the entire sample population. Being careful when going out into the sun so the complexion won't look bad resulted in a big difference between those with vitamin D deficiency than the entire group as a whole, with 81% (n=21) in agreement for those with deficiencies, and only 56.4% (n=57) of the entire sample population.

Concern for wrinkled skin, however, was not much different between those with vitamin D deficiency and all participants. Of those having vitamin D deficiency, 50% (n=13) reported agreement with the statement that they avoid exposure to the sun

because of concerns that it will cause their skin to wrinkle, and for the entire group 50% (n=50) reported agreement. There was some difference between women with vitamin D deficiencies when asking if they covered their skin and use sunscreen because of the risk of cancer, with 58% (n=15) of those having vitamin D deficiencies reporting agreement with this statement and 42% (n=42) reporting agreement from the entire sample population. Lastly, when stating they cover their skin from the sun because of personal religious beliefs, surprisingly only 73.1% (n=19) of women with vitamin D deficiencies reported agreeing with this statement, compared to 85.1% (n=86) from the entire group reported agreeing with this statement (See Table 4).

Table 4- Percentage of Reported Agreement Pertaining to Reasons for Covering*

Questions Relating to Sun Exposure Reasons	Agreement Among Entire Sample Population (n=101) (n=%)		Agreement Among Sample Population Who Tested (+) Vitamin D Deficiency (n=26) (n= %)	
I Cover My Skin Due to Culture/Traditions	79	78.2%	17	65.4%
Others View Light Skin as More Attractive	75	74.3%	23	89%
I Would be Unhappy if My Skin More Darker	51	51%	17	65.4%
I'm Careful Going Into the Sun So I Won't Look Bad	57	56.4%	21	81%
I Avoid the Sun Because My Skin will Wrinkle	50	50%	13	50.0%
I Cover My Skin Because of Risk of Cancer	42	42%	15	58%
I Cover My Skin Because of My Religious Beliefs	86	85.1%	19	73.1%

* Respondents could choose more than one reason

Cross tabulations were conducted to examine the relationship between covering skin as a result of religious beliefs and covering skin as a result of cultural traditions, revealing significant findings (p-value=.000) (See Table 5). Additional comparisons between testing for vitamin D deficiency and being careful when going outside so the skin complexion won't look bad showed significance (p-value =.041) (See Table 6), in addition to viewing showing skin to be immodest because of culture were both statistically significant as well (p-value =.004) (See Table 7).

Table 5- Reported Reasons for Covering Skin: Cultural Beliefs vs. Religion*

Variables	Covering Skin is Due to Religious Beliefs			Total
	1 Disagree	2 No Opinion	3 Agree	
Showing Skin is Not Modest Because of Culture/Traditions				
1 Disagree	1 11.1%	0 .0%	8 9.3%	9 8.9%
2 No Opinion	7 77.8%	2 33.3%	4 4.7%	13 12.9%
3 Agree	1 11.1%	4 66.7%	74 86.0%	79 78.2%
Total	9 100%	6 100%	86 100%	101 100%

* $\chi^2 = 42.48$ *p=0.000

Among participants reporting showing skin in public is not modest because of cultural traditions, 86% (n=74) agreed they cover their skin because of religious beliefs. This indicates 86% (n=74) reported covering skin is a part of both their cultural and religious beliefs. Therefore the connection to religious and cultural beliefs appears to be one in the same. In other words their religious beliefs are quite often what respondents reported their cultural beliefs are, or vice versa, when it comes to covering the skin.

Table 6- Covering the Skin; Culture vs. Aging Skin*

Variable	Avoid Sun Because Skin Will Wrinkle			Total
	1 Disagree	2 No Opinion	3 Agree	
Showing Skin is Not Modest				
Disagree	5 16.7%	2 9.5%	2 4.0%	9 8.9%
No Opinion	3 10.0%	6 28.6%	4 8.0%	13 12.9%
Agree	22 73.3%	13 61.9%	44 88.0%	79 78.2%
Total	30 100.0%	21 100.0%	50 100.0%	101 100.0%

$\chi^2 = 9.940$ *p=.041

Among respondents who reported being in strong agreement with the feeling that showing the skin is not modest because of their cultural traditions, 88% (n=44) also agreed they avoid exposure to the sun because they feel it will make their skin wrinkle. In other words it appears that the vast majority of those who cover their skin due to cultural traditions also avoid sun exposure because they feel it will make their skin wrinkle. Therefore, women who viewed that covering the skin is modest due to culture are also concerned about maintaining wrinkle free skin.

Table 7-Responses to Statement of Avoiding the Sun so their Skin Complexion Won't Look Bad among Women Testing Positive for Vitamin D Deficiency *

Variables	I'm Careful Going Into the Sun So I Won't Look Bad			Total
	1	2 No-	3	
	Disagree	Opinion	Agree	
Tested Positive for Vitamin D Deficiency				
1 Yes	2 25.0%	3 33.3%	21 84.0%	26 61.9%
2 No	6 75.0%	6 66.7%	3 12.0%	15 35.7%
3	0 .0%	0 .0%	1 4.0%	1 2.4%
Total	8 100%	9 100%	25 100%	42 100%

$$*\chi^2 = 15.406 \quad *p = .004$$

Of those individuals who tested positive for having a vitamin D deficiency, 84% (n=21), indicated they are careful when they go out into the sun so their complexion won't look bad. Therefore it seems as though a high proportion of individuals with vitamin D deficiency do not obtain vitamin D through sunlight because of concern for their appearance or beauty.

Within the second research questions which stated that the amount of vitamin D consumed in the diet was examined through asking how many portions of specific food products have been eaten while in their native country and while living in the United States. Findings showed an average consumption of yogurt at their home country was 4.44 cups per week, and in the United States it was 3.76 cups per week. Cheese consumption was reported to be also greater in the home country than in the United States with an average of 7.18 slices or cubes of cheese consumed in their native nation and 6.81 slices or cubes of cheese in the United States. The amount of fish

reportedly consumed revealed the greatest difference in consumption. Averages of 2.81 portions were reportedly consumed weekly in participants' home country, with 1.88 portions consumed in the United States. Therefore, it appears that the consumption for each food product containing a fair amount of vitamin D, was greater in the native country versus the United States.

While orange juice consumption was not measured by comparing consumption in native homeland and the United States, since it is only fortified in the United States, participants were asked if they consume this fortified product. Of those responding, 56 of the 100 participants (one person did not respond), indicated they do consume vitamin D fortified orange juice, 28% do not consume it at all, and 16% are unsure if they consume orange juice that's vitamin D fortified. Of those who reported consuming vitamin D fortified orange juice, the average amount of days per week they reported consuming orange juice was 2.89 days. Data showed that more than 55% of participants were reported consuming orange juice one cup each day within more than twice per week (See Table 8).

Table 8 - Food Portion Consumption in Native Countries versus the United States

Sources of Vitamin D Reported Serving/ Week	Native Countries	USA
Fatty oil/ fish (0.5-1)mg/ml =(20-40)IU	2.81serving/wk	1.88 serving/wk
Fortified orange juice cup/ wk	N/A	2.89 cups/wk.
Yogurt (cups/wk)	4.44 cups/wk	3.76 cups/ wk
Cheese (slices or cubes)	7.18 slices or cubes	6.81 slices or cubes

Additional Findings

Additional findings from the women who were vitamin D deficient gave support to previous literature where symptoms associated with vitamin D deficiency were described, such as body aches, back pain, and bone fractures (9). The relationship between each of the following symptoms was statistically significant: body aches ($P=.004$) (See Table 9), back pain ($P=.016$) (See Table 10), and bone fractures ($P=.026$) (See Table 11).

Table 9– The Relationship between Vitamin D Deficiency and Body Aches*

		Body Aches			Total
		1 Yes	2 No	5	
Vitamin D Deficiency	1 Yes	21	4	1	26
	2 No	4	11	0	15
	3	0	1	0	1
Total		25	16	1	42

* $\chi^2 = 15.318$ * $p=.004$

Table 10– The Relationship Between Vitamin D Deficiency and Back Pain*

		Back Pain		Total
		1 Yes	2 No	
Vitamin D Deficiency	1 Yes	20	6	26
	2 No	5	10	15
	3	1	0	1
Total		26	16	42

* $\chi^2 = 8.294$ * $p=.016$

Table 11- The Relationship between Vitamin D Deficiency and Bone Fractures*

		Bone Fractures		
		1 Yes	2 No	Total
Vitamin D Deficiency	1 Yes	10	16	26
	2 No	1	14	15
	3	1	0	1
Total		12	30	42

* $\chi^2=7.273$ *p =.026

CHAPTER 5

CONCLUSIONS & RECOMMENDATIONS

Summary

Vitamin D is an important fat-soluble substance needed along with calcium to ensure strong bone maintenance. It also aids in absorption of other nutrients, in order to help provide good health. The purpose of this study was to examine potential cultural influences and dietary intake that may have contributed to vitamin D deficiency among Muslim women. Geographic relocation, along with various related vitamin D consumption changes associated with migration, may alter the likelihood of vitamin D deficiency and should therefore be something to consider when examining this population.

As a result of this information, a sample population of convenience obtained from southern Illinois was utilized for the research purposes within this study. Two primary research questions became paramount upon review of the literature. The first research question asked:

1. Do cultural factors such as views of beauty, concerns for health, or religion contribute to lack of sun exposure among immigrant Muslim women, thus increasing the prevalence of vitamin D deficiency?
2. Do Muslim women consume adequate amounts of vitamin D in their diet while in their native homeland, and after immigrating to the United States?

In order to answer these research questions, a survey instrument was adapted with additional created questions added as well. This was done in order to elicit

appropriate responses from the sample population chosen. To assist in encouraging potential respondents to participate in this research study, the local Imam (Islamic prayer leader) made an announcement after prayer on a Friday. As a result of the Islamic lunar month of Ramadan, a large gathering at the Carbondale Civic Center provided the venue for distributing these surveys, given that the local mosque was under construction during that time. There were 120 surveys distributed in this study with 101 questionnaires completed.

Within the survey instrument, cultural and religious views were examined relating to views of beauty and modesty, as well as the degree of covering of the skin. Dietary consumption of fish and dairy products that contain vitamin D were examined as well. In addition to this, questions relating to health problems that might indicate presence of a vitamin D deficiency were also included. Finally, demographic questions were asked to describe characteristics of those participating within the study. Analysis of responses to the questionnaires was examined using the SPSS (Statistical Package for the Social Sciences) statistical package for Windows, Version 18.

Findings

Among the sample population, the average age was 37.2 years, ranging from age 20 to 65. The average amount of time living in the United States was 10.14 years. Some individuals had been in the United States as little as 6 months of a year while one individual reported residing in this country for 40 years. There were 14 countries of origin represented among this population with the greatest numbers originating from Saudi Arabia, Pakistan, Bangladesh and Palestine. Among these women, over 46.6%

had a master's or doctorate degree, and only 7.9% had a high school education or less. As noted in chapter 4, affiliation with Southern Illinois University is common among this group of people, explaining the high level of education among those surveyed.

The first research question involving examination of cultural views of beauty, concerns for health, and religion as they affect sun exposure among Muslim women responses revealed different views between the entire sample population and those having tested positive for vitamin D deficiency. In the first part of this research question, views of beauty revealed the majority of respondents reported they believe the sun will make their skin complexion look bad, make their skin darker in coloration, and will be viewed by others as less attractive. Surprisingly, concern for the skin wrinkling as a result of sun exposure was not that prominent, and almost exactly the same when comparing both groups. The difference between the two groups was greater for other forms of beauty. In other words, this indicates that concern for skin wrinkling is less important than other forms of beauty. Regardless, wrinkling of skin was still important among the entire sample population due to the fairly large proportion, 50% reporting its importance (See Table 4).

Concerning health issues, covering skin because of the risk of cancer also revealed a disparity between the entire sample population and those showing positive for vitamin D deficiency. Individuals with vitamin D deficiency had 58% agreement regarding concern about the risk of cancer, which was much greater than the entire group of subjects where only 42% agreed (See Table 4).

While the vast majority of Muslim women sampled indicated they cover their skin as a result of their religious beliefs, they also stated they cover as a result of their

cultural traditions, unexpectedly, those who reported testing positive for having a vitamin D deficiency were less likely to say they covered because of religious beliefs and cultural traditions, and instead concerns of appearance were revealed (See Table 4). Since female followers of Islam often wear modest clothing and frequently wear a scarf or veil (12,13), this study gives some further insight as to the reasoning behind covering. Additional literature showed that most veiled and non-veiled Muslim women avoid sunlight exposure and wear modest clothing (3,10).

As reported earlier in this study, the connection between religion and culture was expected to be strong. Upon examination, the relationship between the two was found to be statistically significant when conducting a chi-square analysis ($P=.000$) (See Table 5). An interesting relationship was found between covering the skin as a result of cultural traditions and concern that skin would wrinkle due to sun exposure. This relationship was also found to be a statistically significant agreement ($P=.041$) (See Table 6). Although this was a significant relationship, no specific underlying factors associated with this have been discovered through this study. Perhaps those who cover their skin due to cultural traditions are more aware of the effect of the sunlight's potential to cause skin wrinkling. Siddiqui and Kamfar stated that in Saudi Arabia, females are likely to avoid sun exposure due to concern for the harm caused by the intensity of the sun and sociocultural factors including cosmetic reasons (9).

These results show some important differences between responses of the sample population and those who have tested positive for vitamin D deficiency. An interesting discovery was the relationship between testing positive for vitamin D

deficiency and being “careful when going out into the sun” so their skin complexion won't “look bad”. This relationship was statistically significant ($P=.004$) (See Table 7).

Determining consumption of foods containing vitamin D in the diet of Muslim women in their native home and in the United States was the second element among the research questions. Participants indicated they consumed yogurt, cheese, and fish in greater amounts in their native country when compared to consumption of these products in the United States (See Table 8). The portions of fish were consumed much higher degree than other products, and this food substance is a major source of vitamin D for those living in the middle-east. The individual portion size of fish is not often known among Muslim women due to the cultural way in which it is served. It is remarkable to note that while consumption of these dairy products is greater in their country of origin, previous literature reported low levels of vitamin D intake in food substances in their native lands (1,9,21).

In addition to these food substances, calcium fortified orange juice, which is only available uniformly in the United States, is consumed by over half of the sample population. Of those who drink calcium fortified orange juice, over half consume it more than twice weekly. Since there is no comparison between orange juice consumption in other countries and the United States, this is simply an additional source of vitamin D for their diet (See Table 8).

While administering surveys, additional information was discovered as a result of discussions and questions posed by participants. Some of this information obtained is important for a better qualitative understanding to add to the statistical findings. Many women made comments about the frequency of eating fish. While the majority reported

not liking the taste of fish in the United States as much as in their native country (88.4%), they shared that they do enjoy eating boneless fish in the United States. Fish is reportedly consumed more than they would prefer because of the limited access to fresh halal meat in southern Illinois. In addition, there are no Islamic restaurants in this area where halal meat (food conforming to Muslim dietary laws) is available on the menu. The important distinguishing feature of halal meat is that the animal must be slaughtered in the name of Allah (God).

While numerous women spoke of appreciating the variety of yogurt and cheese available in the United States, plain yogurt was consumed primarily in their native country. Yogurt containing fruit is used less often by this population because plain yogurt is a frequent item used while cooking dishes containing rice and meat. When purchasing yogurt and cheese in the United States, many of these women choose to buy these products from the local international food store instead of regular chain food stores located in Carbondale, Illinois. Therefore, although they reported consuming these products, what is eaten is often produced from their native country or from the middle-east.

Another incidental discovery within this research was that several women who participated within this study showed their concern about potential suffering from heat stroke and similar symptoms. This was found to be more prevalent than concern about skin cancer during the collection of responses from the surveys. This information coincides with previous literature which indicates people from these regions limit sun exposure due to the high daytime temperatures (9).

Additional Findings

Prior to examining the research questions, several survey items were asked to determine general knowledge among respondents about the importance of vitamins in the diet and vitamin D specifically as well. Among these questions, it was asked whether or not participants have ever been tested for vitamin D deficiency, and if so, was it positive? In addition, questions were asked to determine what proportion of individuals experience some of the symptoms frequently associated with vitamin D deficiency.

The majority of women, (85.1%) reported that it is important to take multivitamin supplements. Only 62.4% reported actually taking them however. Of those who reported taking vitamin supplements, only 38% reported taking them on a daily basis. As far as knowledge of the importance being taught to each person, 56.4% (n=57) reported being taught about the importance of vitamin D in their native country, and 64.4% (n=65) reported being taught about it while residing in the United States. Approximately 69.3% (n=70) reported having knowledge of the types of foods that contain vitamin D, and 30.7% of participants reported not have knowledge.

The next question asked if each person has experienced symptoms associated with lactose intolerance which were already reported in previous literature (9,21). The symptoms noted were abdominal pain, gas, bloating, or diarrhea, upon consuming foods that contain milk products. Prevalence of symptoms in this study were reported to be severe among 7.9% (n=8) of participants, reported moderate in 27.7% (n= 28) of the research sample, reported a few in 19.8% (n=20) of participants, and 44.6% (n=47)

reported none. From these responses it can be seen that 55.4% (n=56) of all individuals reported least some physical symptoms associated with lactose intolerance.

Additionally, when asking participants if they had previously been tested for vitamin D deficiency, 40.6% (n=41) indicated they had been tested, 57.4% (n=58) indicated they had not, with 2% (n=2) not responding to the question. Of those tested, 45.2% reported being tested less than a year ago, and 23.8% reported being tested between 1 and 2 years ago. There were lower percentages of testing in previous years. Among women who reported being tested for vitamin D deficiency, 61.9% (n= 26) were found to be vitamin D deficient. These participants reported having symptoms consistent with those found in previous research. These symptoms including, body aches, back pain, and bone fractures. (See Tables 9,10,11).

Conclusion

The major finding within this study is the relationship between vitamin D deficiency and concerns of beauty. Concern for beauty is much greater among Muslim women who reported testing positive for vitamin D deficiency than the entire sample population. Those who reported testing positive for vitamin D deficiency stated they cover their skin as a result of traditional or religious reasons less than the sample population as a whole. It appears among those women, beauty seems to supersede concerns of tradition and religion.

The second major finding involves the reported intake of vitamin D within the weekly diet. From survey results and conversations with participants, it was found that fish, which is a regular part of their diet, is consumed more in their native homeland

predominately due to taste. Individuals reported greater intake of yogurt and cheese in their native country as well, also due to taste. According to the National Institute of Health Dietary Supplement Fact Sheet, natural food products containing large amounts of fish oils contain higher amounts of vitamin D than fortified foods.

Recommendations

This study appears to be the first of its kind that has identified a relationship between vitamin D deficiency and views of beauty among Muslim women. As a result, efforts towards educating Muslim women about the importance of testing for vitamin D deficiency, and necessity of having at least 15 to 30 minutes of sun exposure per day at least three times weekly should be encouraged (2,25). Muslim women should also be encouraged to proactively ask their medical professionals to test them for vitamin D deficiency. Individuals with high risk for having vitamin D deficiency should take 1,000 IU of vitamin D₃ daily and those who do not get tested, should have at least 2,000 IU of vitamin D₃ daily (2, 25). Physicians should routinely test their female Muslim patients for measuring 25(OH)D in serum blood level, and inform them about the importance of vitamin D regarding general health. Other health providers such as dietitians and the media should encourage individuals to consume adequate amount of vitamin D₃ in their diet, and to increase brief exposure to sunlight in Muslim countries, thereby working to change attitudes towards healthy sun exposure.

While this study found some important findings, additional research should be conducted where vitamin D deficiency testing of a large group of participants is done. Findings were limited due to the number of individuals having been previously tested

among this sample population. Additionally, not all countries where Muslim women reside were represented, and there was an assumption that all participants fully understood how to determine measurements of servings. The fact that mosques in Carbondale were only included in this survey, and the survey was implemented during the month of Ramadan were delimitations to this study.

A study conducted with greater numbers of women having been tested prior to survey might give supplementary information that might contribute to knowledge about these individuals. Additional research may give supporting results which can lead to further insight regarding this issue.

Another area which may be considered for future research is the examination of genetic predisposition. Are individuals from Muslim nations genetically predisposed to vitamin D deficiencies? Are there certain genetic markers that can help people from this region discover the likelihood of having a vitamin D deficiency, so it can be treated? These are just a couple of the ways in which genetic research might assist Muslim women in their efforts to maintain nutritional health.

Other implications involve the need for medical professionals to determine ways to encourage women who are concerned about their aesthetic beauty to alter their level of sun exposure in some way that will not be taken negatively. Along with plans to address this, concerted efforts need to be made to stress the significance of vitamin D deficiency and related problems among the Muslim population.

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APPENDICES

APPENDIX A**Consent Form**

PARTICIPANT CONSENT FORM

My name is Durar Shakir. I am a graduate student at Southern Illinois University- Carbondale.

I am asking you to participate in my research study. The purpose of my study is to examine cultural influences regarding inadequate sun exposure in modestly clothed immigrant Muslim women relating to vitamin D deficiency. The study will also examine dietary changes among this population in order to ascertain if there are any increased or decreased risks as a result of geographic relocation.

Participation is voluntary. If you choose to participate in the study, it will take approximately 10-15 minutes of your time. You will need to fill out the survey. Once you have it completed, you will be asked to turn it in to a Shakir's envelope, which I will be holding.

All your answers will be kept confidential within reasonable limits. Nobody will have access to your answers. In other word, I will take all reasonable steps to protect your identity.

If you have any questions about the study, please contact me.

Durar Shakir, (618) 924-0629

Signature_____

Thank you for taking the time to assist me in this research.

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, SIUC, Carbondale, IL 62901-4709. Phone(618) 453-4533. E-mail: siuhsc@siu.edu

APPENDIX B

SIUC Human Subject Committee Approval

APPENDIX C

Survey Instrument

Vitamin Consumption and Health Questions

1. Do you think it's important to take multivitamin supplements? Yes ____ No ____
2. Do you take multivitamin supplements? Yes ____ No ____ Sometimes ____
3. If you do take multivitamin supplement, how many times each week do you take them? _____
4. Have you ever been taught about the importance of vitamin D and how it helps your body absorb calcium before coming to the United States? Yes ____ No ____
5. Have you ever been taught about the importance of vitamin D and how it helps your body absorb calcium since coming to the United States? Yes ____ No ____
6. Have you ever been tested for vitamin D deficiency? Yes ____ No ____
7. If you have been tested, how long ago were you tested? _____
8. If you were tested, were you found to have a vitamin D deficiency? Yes ____ No ____
9. Do you know what foods contain vitamin D? Yes _____ No _____
10. When you drink or eat foods with milk products in them, do you get abdominal pain, gas, bloating, or diarrhea as a result?

1 _____	2 _____	3 _____	4 _____	5 _____
Severe	Some	Moderate	Few	None
11. Do you suffer from body aches (pain) on a regular basis? Yes ____ No ____
12. Do you suffer from back pain unrelated to an injury? Yes ____ No ____
13. Have you suffered from bone fractures unrelated to a specific injury?
Yes ____ No ____

Food Consumption

Please respond to questions 15 and 16 by putting the number in each blank as follows:

1=Frequently

2=Sometimes

3=Rarely

4=Never

14. In the US how frequently do you eat these milk products?

a. ____ Milk b. ____ Yogurt c. ____ Cheese d. ____ Butter/Margarine

15. In your native country, how frequently did you eat these milk products?

a. ____ Milk b. ____ Yogurt c. ____ Cheese d. ____ Butter/Margarine

16. Does milk in the United States tastes as good as in your native country?

Yes ____ No ____

17. Does yogurt in the United States taste as good as in your native country?

Yes ____ No ____

18. How many cups of yogurt did you eat in your native country per week? _____

19. How many cups of yogurt do you eat in the United States per week? _____

20. Does cheese in the United States taste as good as in your native country?

Yes ____ No ____

21. How many cubes/slices/ounces of cheese did you eat in your native country per week? _____

22. How many cubes/slices/ounces of cheese do you eat in the United States per week? _____

23. Do you like to eat fish? Yes ____ No ____ If No, skip to question number 28.

24. Does fish in the United States taste as good as in your native country?

Yes ____ No ____

25. How many times did you eat fish per week in your native country? _____

26. How many times do you eat fish per week in the United States? _____

27. Do you drink orange juice that is fortified with vitamin D? Yes ___ No ___ Unknown ___

a. If so, how many cups do you drink per week? _____

Sun Exposure

On a scale of 1 to 5 rank questions 29 to 35. 1 indicating **Strongly Disagree** to 5 indicating **Strongly Agree**.

Strongly disagree	Disagree	No opinion	Agree	Strongly agree
1	2	3	4	5

28. I feel that showing my skin in public is not modest because of my culture (traditions).

29. I think most people think light colored skin is more attractive than darker skin. _____

30. I would be unhappy if the sun made my skin darker. _____

31. I am careful when I go out into the sun so my skin complexion (appearance) won't look bad. _____

On a scale of 1 to 5 rank questions 36 to 43. 1 indicating **Never** to 5 indicating **Always**.

Never	Rarely	Sometimes	Frequently	Always
1	2	3	4	5

32. I try to avoid exposure to the sun because I feel it will make my skin wrinkle. _____

33. I cover my skin and use sun screen because of the risk of cancer. _____

34. When I'm outside of the house during the day my legs are covered. _____

35. When I'm outside of the house during the day my arms are covered. _____

36. When I'm outside of the house during the day my hair/head is covered (hijab). _____

37. I cover my skin from the sun because of my religious beliefs. _____

38. I cover my skin and hair less than in my native country? _____

Demographic Questions

39. What is your age? _____

40. How long have you been living in the United States? _____

41. What is your country of origin? _____

42. What level of education best describes you?

43. Less than high school _____ High School _____ Some college _____ Bachelor's
Degree _____ Some Post Graduate study _____ Graduate Degree _____
Doctorate _____

By completing this survey you have agreed to participate in this study.

Thank you for taking the time to complete this survey

APPENDIX D

Internal Consistency and Pilot Survey

Vitamin Consumption and Health Questions

1. Do you think it's important to take multivitamin supplements? Yes ____ No ____
2. Do you take multivitamin supplements? Yes ____ No ____ Sometimes ____
3. If you do take multivitamin supplement, how many times each week do you take them? ____
4. Have you ever been taught about the importance of vitamin D and how it helps your body absorb calcium before coming to the United States? Yes ____ No ____
5. Have you ever been taught about the importance of vitamin D and how it helps your body absorb calcium since coming to the United States? Yes ____ No ____
6. Have you ever been tested for vitamin D deficiency? Yes ____ No ____
7. If you have been tested, how long ago were you tested? _____
8. If you were tested, were you found to have a vitamin D deficiency? Yes ____ No ____
9. Do you know what foods contain vitamin D? Yes ____ No ____
10. When you drink or eat foods with milk products in them, do you get abdominal pain, gas, bloating, or diarrhea as a result?
 1 ____ 2 ____ 3 ____ 4 ____ 5 ____
 Severe Some Moderate Few None
11. Do you suffer from body aches (pain) on a regular basis? Yes ____ No ____
12. Do you suffer from back pain unrelated to an injury? Yes ____ No ____
13. Have you suffered from bone fractures unrelated to a specific injury? Yes ____ No ____

14. *Have you experienced pain in your bones for unknown reasons? Yes ____ No ____

Food Consumption

Please respond to questions 15 and 16 by putting the number in each blank as follows:

1=Frequently 2=Sometimes 3=Rarely 4=Never

15. In the US how frequently do you eat these milk products?

a. ____ Milk b. ____ Yogurt c. ____ Cheese d. ____ Butter/Margarine

16. In your native country, how frequently did you eat these milk products?

a. ____ Milk b. ____ Yogurt c. ____ Cheese d. ____ Butter/Margarine

17. Does milk in the United States tastes as good as in your native country?

Yes ____ No ____

18. Does yogurt in the United States taste as good as in your native country?

Yes ____ No ____

19. How many cups of yogurt did you eat in your native country per week? ____

20. How many cups of yogurt do you eat in the United States per week? ____

21. Does cheese in the United States taste as good as in your native country? Yes

____ No ____

22. How many cubes/slices/ounces of cheese did you eat in your native country per week? ____

23. How many cubes/slices/ounces of cheese do you eat in the United States per week?

24. Do you like to eat fish? Yes ____ No ____ If no, skip to question number 28.

25. Does fish in the United States taste as good as in your native country?

Yes ____ No ____

26. How many times did you eat fish per week in your native country? ____

27. How many times do you eat fish per week in the United States? ____

28. Do you drink orange juice that is fortified with vitamin D? Yes__ No__ Unknown ____

b. If so, how many cups do you drink per week? ____

Sun Exposure

On a scale of 1 to 5 rank questions 29 to 35. 1 indicating **Strongly Disagree** to 5 indicating **Strongly Agree**.

Strongly disagree	Disagree	No opinion	Agree	Strongly agree
1	2	3	4	5

29. I feel that showing my skin in public is not modest because of my culture (traditions).

30. *I think lighter colored skin is more attractive than darker skin. ____

31. I think most people think light colored skin is more attractive than darker skin. ____

32. I would be unhappy if the sun made my skin darker. ____

33. *I think people with sun tans look more attractive. ____

34. *I think skin lightening cream helps dark skinned people look more attractive. ____

35. I am careful when I go out into the sun so my skin won't get darker. ____

On a scale of 1 to 5 rank questions 36 to 43. 1 indicating **Never** to 5 indicating **Always**.

Never	Rarely	Sometimes	Frequently	Always
1	2	3	4	5

36. I try to avoid exposure to the sun because I feel it will make my skin wrinkle. _____

37. I cover my skin and use sun screen because of the risk of cancer. _____

38. *When I am not busy during the day I like to spend time outdoors. _____

39. When I'm outside of the house during the day my legs are covered. _____

40. When I'm outside of the house during the day my arms are covered. _____

41. When I'm outside of the house during the day my hair/head is covered (hijab). _____

42. I cover my skin from the sun because of my religious beliefs. _____

43. I cover my skin and hair less than in my native country? _____

Demographic Questions

44. What is your age? _____

45. How long have you been living in the United States? _____

46. What is your country of origin? _____

47. What level of education best describes you?

48. Less than high school _____ High School _____ Some college _____ Bachelor's
Degree _____ Some Post Graduate study _____ Graduate Degree _____
Doctorate _____

* Questions that have been removed after the pilot study.

By completing this survey you have agreed to participate in this study.
Thank you for taking the time to complete this survey

Internal Consistency

Vitamin Consumption and Health Questions

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.298	.811	5

Inter-Item Correlation Matrix

	Have VD	Body Aches	Back Pain	Bone Fracture	Bone Pain
HaveVD	1.000	.350	.800	.632	.400
BodyAches	.350	1.000	.550	.791	-.338
BackPain	.800	.550	1.000	.791	.345
BoneFracture	.632	.791	.791	1.000	.305
BonePain	.400	-.338	.345	.305	1.000

Food Consumption**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.497	.530	8

Inter-Item Correlation Matrix

	Avoid Sun	Cover Cancer	Cover Legs	Cover Arms	Cover Hair	Cover Religious	Cover USvH	Time Outdoors
AvoidSun	1.000	.630	-.052	.007	-.038	.072	.354	-.158
Cover Cancer	.630	1.000	-.149	-.230	-.116	.223	.028	-.308
CoverLegs	-.052	-.149	1.000	.585	.552	.304	.069	-.422
CoverArms	.007	-.230	.585	1.000	.944	.567	.247	-.147
CoverHair	-.038	-.116	.552	.944	1.000	.575	.233	-.190
Cover Religious	.072	.223	.304	.567	.575	1.000	-.076	-.053
CoverUSvH	.354	.028	.069	.247	.233	-.076	1.000	.014
Time Outdoors	-.158	-.308	-.422	-.147	-.190	-.053	.014	1.000

Sun Exposure**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.094	.155	7

Inter-Item Correlation Matrix

	Exposure Culture	Light Attract	Others Light Attract	Unhappy Dark	Tan Attractive	Light Cream Attract	Careful Darker
Exposure Culture	1.000	.058	.176	-.334	.218	-.112	-.158
LightAttract	.058	1.000	.547	.232	.109	-.208	.178
OthersLight Attract	.176	.547	1.000	.319	-.163	-.286	.328
Unhappy Dark	-.334	.232	.319	1.000	-.401	.037	.448
TanAttractive	.218	.109	-.163	-.401	1.000	-.072	-.272
LightCream Attract	-.112	-.208	-.286	.037	-.072	1.000	-.109
Careful Darker	-.158	.178	.328	.448	-.272	-.109	1.000

VITA
Graduate School
Southern Illinois University

Durar K Shakir

1209 Travis Lane, Carterville, Illinois, 2918

Southern Illinois University at Carbondale
Bachelor of Science, Food and Nutrition, May 2009

Scholastic Honors, May 2009

Thesis Title:

Vitamin D Deficiency and Cultural Influences Among Muslim Women in
Southern Illinois.

Major Professor: Dr. Sara Long, PhD, RD